Plant Community Structure in River Channels

Expectation: Shifts in plant community structure in restored river channels:

i) Combined mean proportional cover of emergent species (*Nuphar lutea, Polygonum densiflorum, Sacciolepis striata, Hydrocotyle umbellata, and Panicum hemitomon)* will increase to >80%.

ii) Combined mean proportional cover of floating and mat-forming species *(Scirpus cubensis, Salvinia minima,* and *Pistia stratiotes)* will decrease to <5%.

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Relevant Endpoints: Sociopolitical - Nuisance (Exotic) Species
Restoration - Biological Integrity - Community Structure
Restoration - System Functional Integrity - Habitat Quality

Reference Condition: Prior to channelization *Nuphar lutea, Sacciolepis striata, Polygonum densiflorum, Scirpus cubensis, Eichhornia crassipes, Hydrocotyle umbellata, Pistia stratiotes,* and *Panicum hemitomon* were probably common in littoral zones of the Kissimmee River (Toth et al. 1995). Quantitative reference condition data on river channel plant communities were obtained in June 1998 from a semi-restored river channel in Pool B after it had received continuous flow for six-nine months (Figure 1). Flow was diverted to the channel by a weir across C-38 (Toth 1991). Cover class (Daubenmire 1959) data from a field survey of 13 river channel transects (C. Hovey, unpublished data) and cover estimates from photointerpretation of 1998 aerial photography (C. Hovey, unpublished results) were used to estimate proportional cover of plant species. Although the run was not fully restored, the data are indicative of probable plant community structure in a fully restored system.

Several emergent species, *Polygonum densiflorum, Nuphar lutea, Sacciolepis striata*, *Hydrocotyle umbellata*, and *Panicum hemitomon* dominated littoral zones in the semi-restored channel. Based on photointerpretation of the 1998 photography, combined proportional cover of *P. densiflorum, N. lutea, S. striata, H. umbellata, and P. hemitomon* comprised 97% of total vegetation cover in the semi-restored run; *P. densiflorum* accounted for 46% of total vegetation cover, *N. lutea* for 25%, *S. striata* for 11%, *H. umbellata* for 8%, and *P. hemitomon* for 5% (Table 1). Based on the 1998 field survey data, mean combined proportional cover of *P. densiflorum, N. lutea, S. striata, H. umbellata*, and *P. hemitomon* was 83.1 ± 5.4 (one standard error)%. Mean proportional cover of these species was: *P. densiflorum,* 37.3 ± 7.7%; *N. lutea,* 29.0 ± 7.1%; *S. striata,* 4.0 ± 2.1%, *H. umbellata* 13.7 ± 3.2%, and *P. hemitomon* 5.9 ± 2.5% (Table 2). *Salvinia minima* (a common floating species) and *Scirpus cubensis* (a mat-forming species) were not found in either survey (Tables 1-2). The photointerpretation-based estimate of proportional cover of another floating species, *Pistia stratiotes*, was 2%, while mean proportional cover of *P. stratiotes* in the field survey data was 2.2 ± 1.5% (Table 2).

Baseline Condition: Transects were established in Pool A (control study area) and Pools B and C (impact study area) to provide baseline data for detection of changes resulting from restored flow. Sampling was conducted in 1998 and 1999 in February-March (dry season), except in 1998, when dry season sampling extended into May, and in August-September (wet season). Baseline surveys of river channel vegetation beds were conducted along 93 one-meter wide belt transects at systematically-selected bends and straight reaches of remnant river channels. Cover classes (Daubenmire 1959) of all species were recorded in contiguous 2 m x 1 m quadrats along the transect. Proportional cover of each species in each bed was calculated as the sum of quadrat cover class midpoints for each species,

divided by the sum of midpoints of all species in the bed. Mean proportional cover was calculated for each species by averaging the proportional cover values for that species in all beds in the subset of interest (e.g., the impact area).

Salvinia minima (mean proportional cover 20.1 ± 0.6%), a floating species, and *Scirpus cubensis* (mean proportional cover 10.0 ± 0.6%), a mat-forming species, were among the most abundant species in the impact study area (Figure 2). *Scirpus cubensis* forms thick floating mats that often encroach on mid-channel areas in the channelized system. These mats provide substrate for a variety of emergent species and shrubs, including *Ludwigia peruviana*. *Pistia stratiotes*, a floating species, also had high mean proportional cover (8.7 ± 0.8%). *Nuphar lutea* had mean proportional cover of 11.7 ± 0.8% (Figure 2) and accounted for approximately half of all emergent vegetation cover in the impact study area. The control area had a similar pattern of species composition and dominance (Figure 3): mean proportional cover of *Nuphar lutea* was 30.4 ± 1.7%, *Salvinia minima* 13.6 ± 0.9%, and *Scirpus cubensis* 6.7 ± 0.8%.

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The combined mean proportional cover of the emergent species *Nuphar lutea, Polygonum densiflorum, Hydrocotyle umbellata, Panicum hemitomon,* and *Sacciolepis striata* was 41.4 ± 1.2% in the impact area (Figure 4) and 55.6 ± 1.3% in the control area. These species were the most common emergents in the reference data.

The combined mean proportional cover of the dominant floating and mat-forming species *Scirpus cubensis*, *Salvinia minima,* and *Pistia stratiotes* was 38.7 ± 1.0% in the impact area (Figure 5) and 25.1 ± 1.3% in the control area.

Reference and baseline mean proportional cover for groups of species are compared in Figure 6.

Mechanism for Achieving Expectation:

Changes in community structure of littoral zones are dependent on the return of flow to remnant river channels. Initial high flows through river channels will remove much of the mid-channel vegetation. Because many of the mid-channel species are exotics, this initial flow will cause a significant reduction in cover of floating and mat-forming species, including exotic species. Subsequently, flow must be sustained so that species better suited to continuous flow and varying water levels can become established and dominant.

Cover of species adapted to nonflowing conditions and relatively stable water depths (i.e., the mat-forming and floating species *Scirpus cubensis, Salvinia minima,* and *Pistia stratiotes*) will decline, while cover of species adapted to flow and fluctuating water levels (primarily the emergent species *Polygonum densiflorum, Sacciolepis striata, Hydrocotyle umbellata, Panicum hemitomon,* and *Nuphar lutea*), will increase and dominate littoral vegetation beds.

Adjustment for External Constraints:

Because of the need for flood control in the upper Kissimmee basin, there may be periods of low or no flow after backfilling of C-38 is complete. During these times, cover of floating and submergent species, particularly *Pistia stratiotes*, *Eichhornia crassipes*, and *Hydrilla verticillata*, may expand. To maintain navigation through the channel, these nuisance species may be treated with herbicides, which will likely affect other vegetation growing in the littoral zones. The sampling schedule will be coordinated with herbicide treatments.

Means of Evaluation:

Evaluation of post-restoration success will begin in February-March 2000. Although Phase 1 of C-38 backfilling will not be complete at this time, the lower river runs of Pool C will be evaluated to track progression of littoral bed change following restoration. Sampling will continue semi-annually for at least two years. Post-restoration sampling methodology will be identical to baseline sampling.

	Statistical tests to determine whether expectations have been met will be assessed for statistical significance at α=0.05.
Time Course:	Changes in plant community structure are expected one to three years after backfilling and restored flow (Toth, 1995).

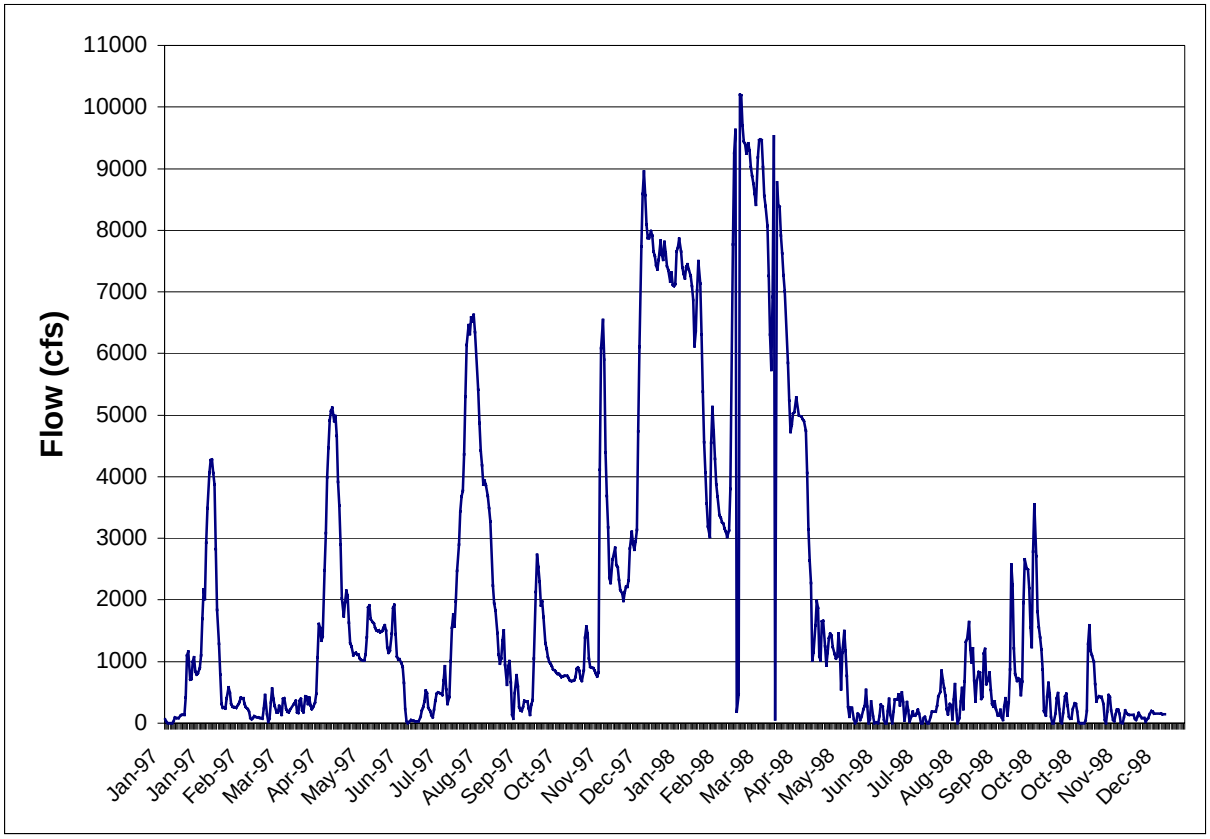


Figure 1. Discharge at S65-B, 1997-1998. Data from SFWMD 2001.

Table 1. Proportional cover of river channel plant species in a semi-restored river channel of Pool B following an extended period of moderate to high flow. Based on photointerpretation of 1998 aerial photography (estimates from C. Hovey).

Species	Proportional cover
Polygonum densiflorum	46
Nuphar lutea	25
Sacciolepis striata	11
Hydrocotyle umbellata	8
Panicum hemitomon	5
Pistia stratiotes	2
Pontederia cordata	1
Eichhornia crassipes	1
Sagittaria spp.	1

Table 2. Mean proportional cover of river channel plant species in a semi-restored run in Pool B following an extended period of moderate to high flow. Based on June 1998 field surveys of 13 transects (data from C. Hovey).

Species	Mean proportional cover	SE
Polygonum densiflorum	37.3	7.7
Nuphar lutea	29.0	7.1
Hydrocotyle umbellata	13.7	3.2
Panicum hemitomon	5.9	2.5
Sacciolepis striata	4.0	2.1
Eichhornia crassipes	2.8	1.7
Pistia stratiotes	2.2	1.5
Eleocharis vivipara	1.8	1.4
Sagittaria lancifolia	1.4	1.4
Pontederia cordata	0.9	0.6
Polygonum punctatum	0.8	0.6

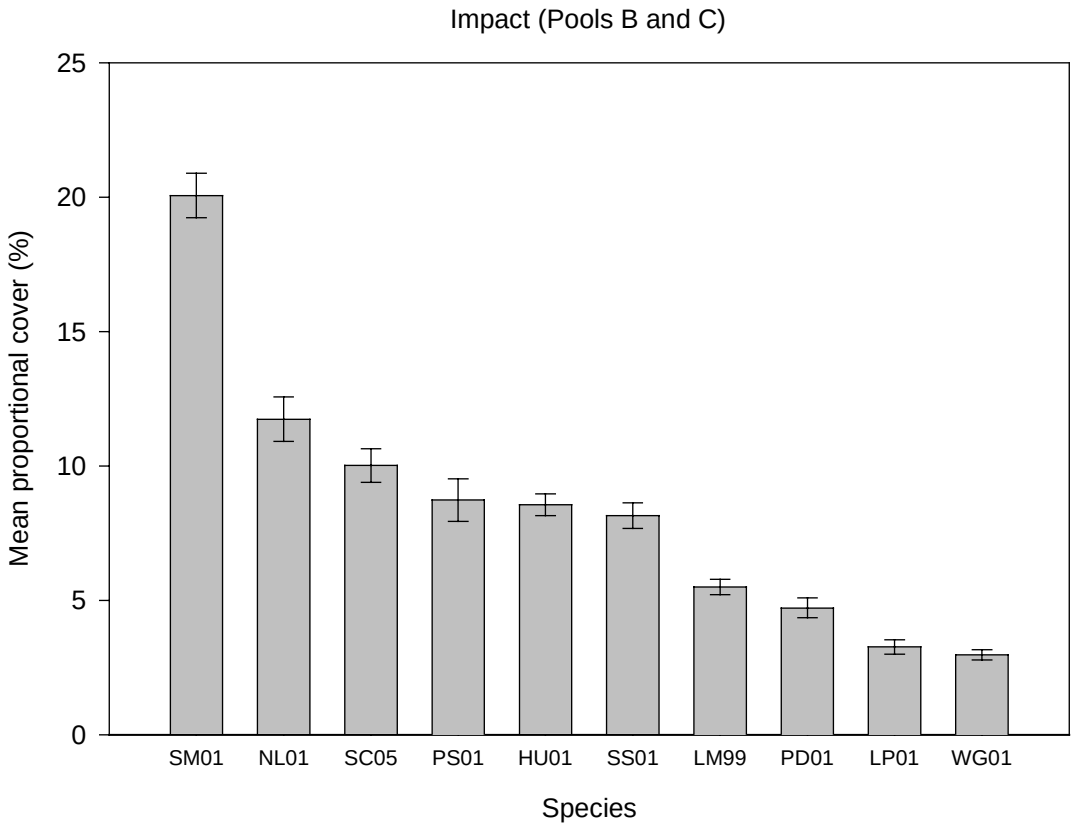


Figure 2. Plant species with highest mean proportional cover in the baseline survey of remnant river channels in the impact study area (Pools B and C). Error bars indicate ± one standard error of the mean.

Key to species codes:

HU01	*Hydrocotyle umbellata*
LM99	*Lemna sp.*
LP01	*Ludwigia peruviana*
NL01	*Nuphar lutea*
PD01	*Polygonum densiflorum*
PS01	*Pistia stratiotes*
SC05	*Scirpus cubensis*
SM01	*Salvinia minima*
SS01	*Sacciolepis striata*
WG01	*Wolffiella gladiata*

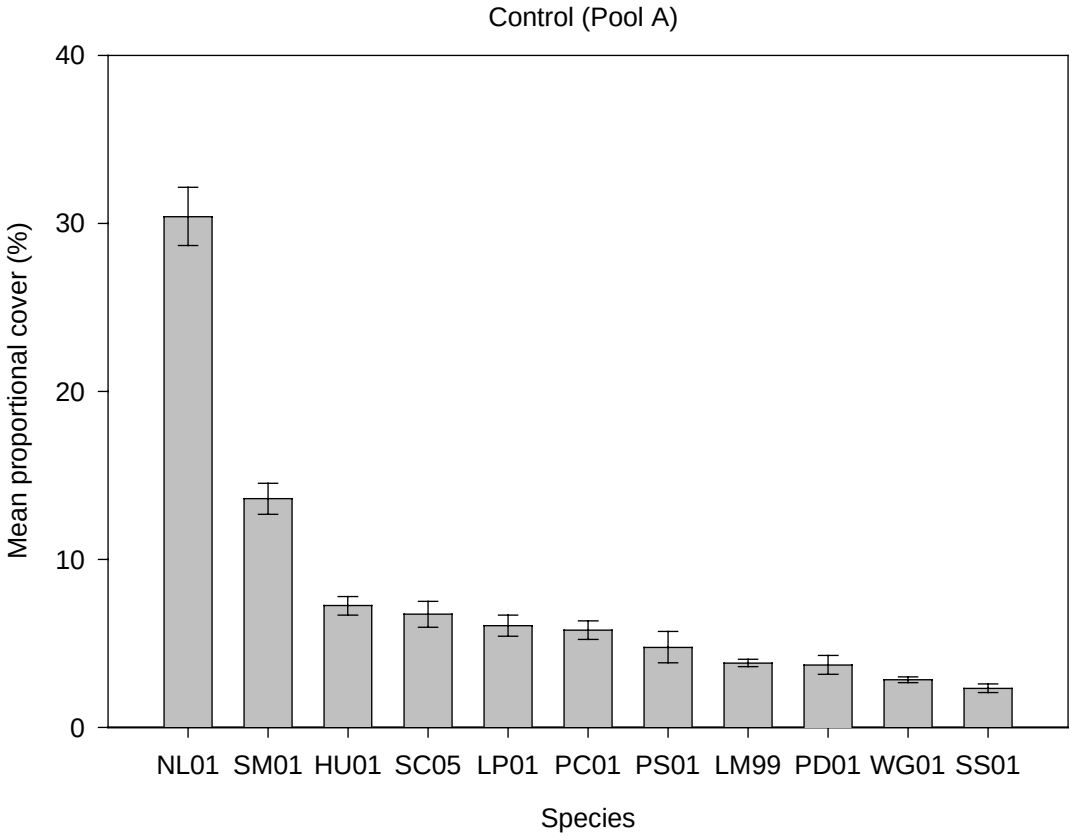


Figure 3. Plant species with highest mean proportional cover in the baseline survey of remnant river channels in the control study area (Pool A). Error bars indicate ± one standard error of the mean.

Key to species codes:

HU01	*Hydrocotyle umbellata*
LM99	*Lemna sp.*
LP01	*Ludwigia peruviana*
NL01	*Nuphar lutea*
PD01	*Polygonum densiflorum*
PS01	*Pistia stratiotes*
SC05	*Scirpus cubensis*
SM01	*Salvinia minima*
SS01	*Sacciolepis striata*
WG01	*Wolffiella gladiata*

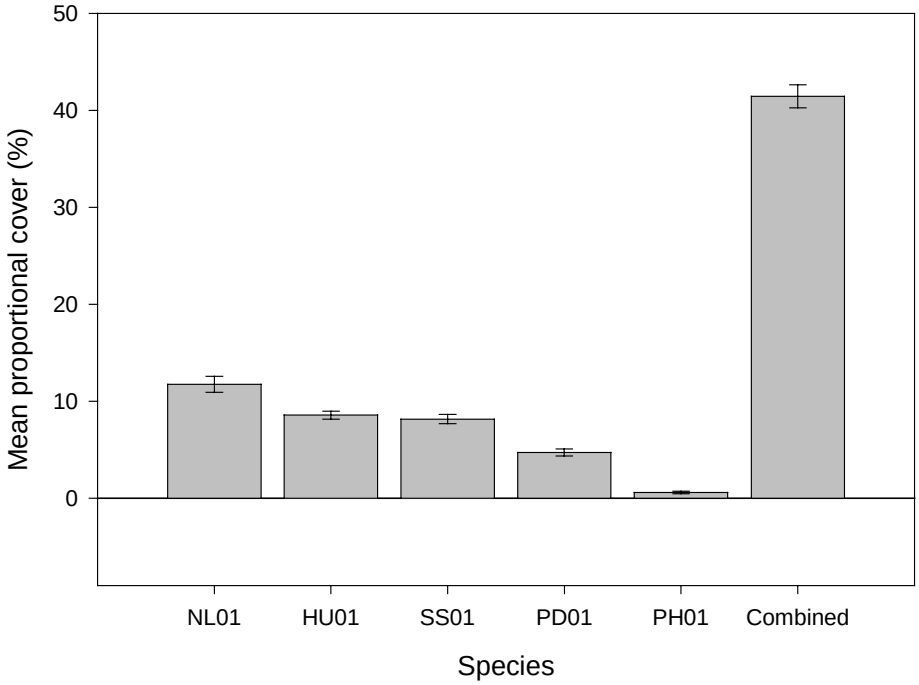


Figure 4. Mean proportional cover of *Nuphar lutea* (NL01), *Hydrocotyle umbellata* (HU01), *Polygonum densiflorum* (PD01), *Sacciolepis striata* (SS01), *Polygonum densiflorum* (PD01), and *Panicum hemitomon* (PH01), and their combined cover, in remnant river channels in the impact study area (Pools B and C). Error bars indicate ± one standard error of the mean.

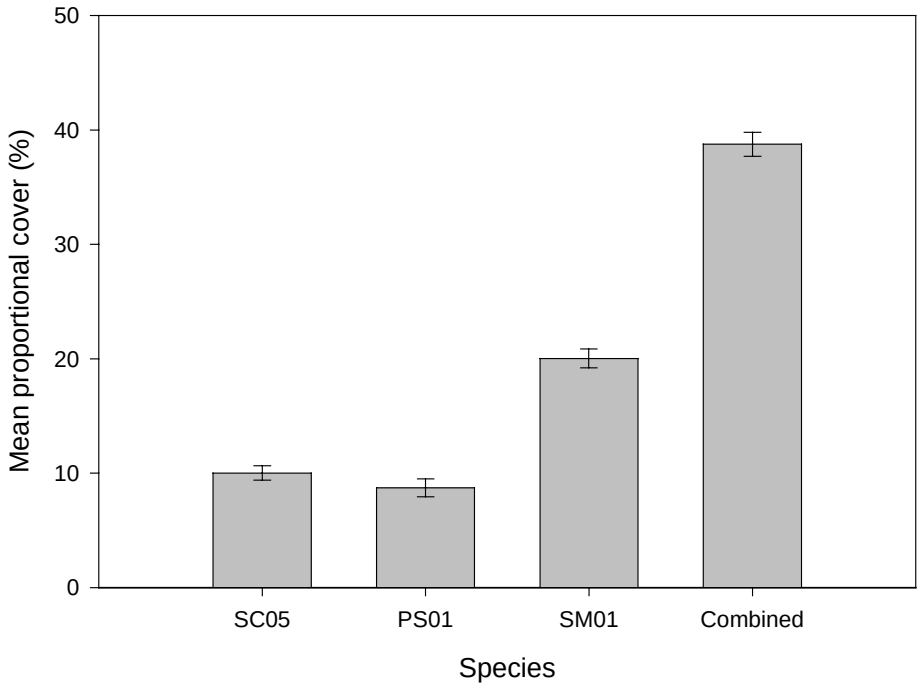
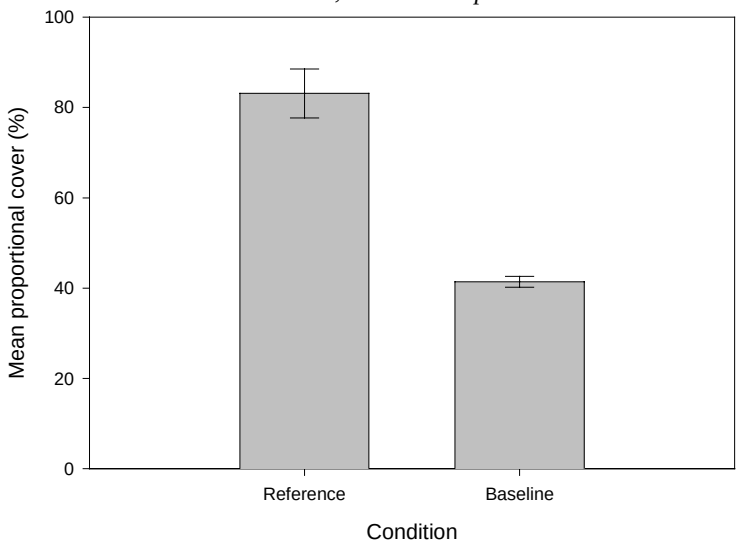


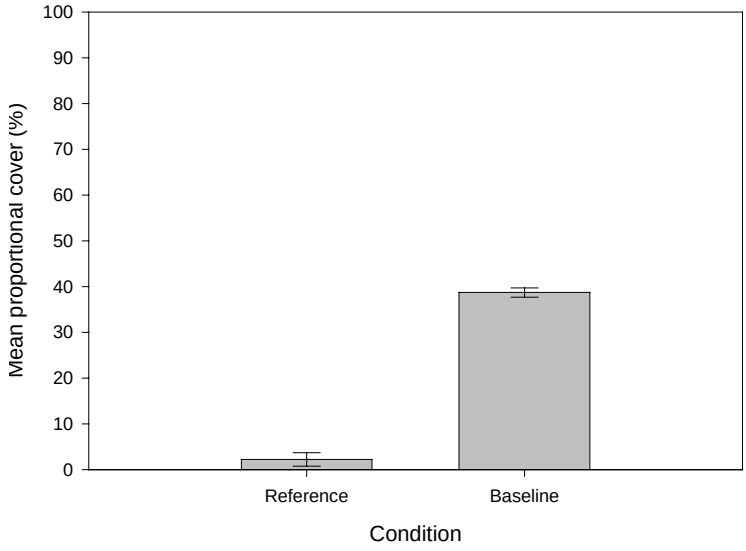
Figure 5. Mean proportional cover of *Scirpus cubensis* (SC05), *Salvinia minima* (SM01), and *Pistia stratiotes* (PS01), and their combined mean proportional cover, in remnant river channels in the impact study area (Pools B and C). Error bars indicate ± one standard error of the mean.

Figure 6 a-b. Mean proportional cover of (a) dominant emergent species and (b) dominant floating and mat-forming species in reference data and the baseline impact area (Pools B and C). Error bars indicate ± one standard error of the mean.

a) Mean combined proportional cover of *Nuphar lutea, Polygonum densiflorum, Hydrocotyle umbellata, Panicum hemitomon,* and *Sacciolepis striata.*



b) Mean combined proportional cover of *Scirpus cubensis, Salvinia minima,* and *Pistia stratiotes.*



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